

- ART 528. Art and Architecture in Northern Europe 3 cr.  
Architecture, painting, and sculpture in Flanders, Holland, France, England, and Germany as indigenous developments and as reflections of the Italian Baroque. Prerequisite: graduate standing.
- ART 529. Survey of Western Architecture 3 cr.  
Survey of history of Western architecture from prehistoric time to the present. Prerequisites: ART 295 and ART 296.
- ART 530. Modern Architecture 3 cr.  
Study of the architecture of the later eighteenth, nineteenth and twentieth centuries in the context of technological, social and stylistic changes. Focus on the works of Louis Sullivan, Frank Lloyd Wright, and European architects of the International Style, and the current reaction. Prerequisite: graduate standing.
- ART 533. Baroque Art and Architecture in Italy, Spain, and Hispanic Latin America 3 cr.  
Concentration on Italian and Spanish Baroque architecture, painting, and sculpture, as well as the art and architecture of Spanish vice-royalties of the Americas. Prerequisite: graduate standing.
- ART 537. American Art to 1900 3 cr.  
Covers the history of painting, sculpture, architecture, and other arts in the United States from the colonial period to 1900. Prerequisite: graduate standing.
- ART 538. Late Eighteenth- and Nineteenth-Century European Art 3 cr.  
History of painting, sculpture, architecture, and other arts created in Europe from 1789 to 1900. Prerequisite: graduate standing.
- ART 542. Twentieth-Century Art I, 1900-1945 3 cr.  
History of painting, sculpture, and other arts in Europe, the United States, and elsewhere from 1900 to 1945. Prerequisite: graduate standing.
- ART 543. Twentieth-Century Art II, 1945-Present 3 cr.  
History of painting, sculpture, and other arts in Europe, the United States, and elsewhere from 1945 to the present. Comprehensive research paper required. Prerequisite: graduate standing.
- ART 544. Art and Life in Renaissance Italy 3 cr.  
Examines how Italian Renaissance textual and visual culture offered Europe new ways of seeing and portraying itself, 1350-1550. Topics include: Florence, Venice, Rome, Leonardo, Michelangelo, Titian, humanism, the Medici, and republican and courtly culture. Prerequisites: ART 295, 296, 297. Same as HIST 542.
- ART 549. Advance Figure Drawing 3 cr. (2+4P)  
Advanced figure drawing class with emphasis on developing technical and conceptual skills. Prerequisite: ART 449
- ART 550. Drawing Workshop 3 cr.  
A critique class based on drawing done outside of class. Emphasis on development of technical and conceptual skills. Restricted to graduate art students. May be repeated up to 27 credits.
- ART 555. Graphic Design 3 cr.  
May be repeated up to 27 credits.
- ART 557. Typographic Design and the Computer 3 cr. (2+4P)  
Typography and communication in graphic design. Emphasis on innovative typography and the exploration of graphic formats. Advanced projects created using conventional and digital tools. Prerequisite: graduate standing. May be repeated for a maximum of 6 credits.
- ART 560. Painting Workshop 3-9 cr.  
Advanced work with painting skills. Emphasis on critical analysis and development of body of work. Restricted to graduate art students. May be repeated up to 27 credits.
- ART 565. Sculpture Media 3-9 cr.  
May be repeated up to 27 credits.
- ART 566. Digital Photography, Image Capture and Output 3 cr. (2+4P)  
Introduction to digital workflow in photography. Topics include digital camera operation, RAW file processing, scanning, color management and printing. Course will emphasize concepts of ideation and thematic coherence. May be repeated up to 6 credits.
- ART 567. Pinhole Photography 3 cr.  
Construction and use of pinhole cameras. Includes experimental cameras, color and black and white materials. Reading and critique. Prerequisites: ART 270, ART 271, and ART 370. Restricted to majors.
- ART 569. The Constructed Image 3 cr.  
Covers advanced work with manipulation of conventional photographic materials and issues of post visualization. Emphasis on creation of an extended body of work. Prerequisite: consent of instructor. Restricted to majors.
- ART 570. Projects in Photography 3-9 cr.  
Independent work on advanced long-term projects. May be repeated for a maximum of 30 credits.
- ART 571. Large Format Photography and Lighting 3 cr.  
Assist in the instruction of ART 271 by giving demonstrations and lectures and learning photo lab management. Prerequisite: consent of instructor. Restricted to majors.
- ART 575. Ceramic Arts 3-9 cr.  
May be repeated up to 27 credits.
- ART 576. Museum/Gallery Research Internship 1-9 cr.  
Research internship in museum or gallery. Requirements determined by instructor in cooperation with supervising museum/gallery professional. For art history credit. Prerequisite: graduate standing. May be repeated for a maximum of 9 credits.
- ART 577. Independent Research Problems in Art History 1-9 cr.  
Advanced research on special problems to be conducted under supervision of art history faculty. Prerequisite: graduate standing. May be repeated for a maximum of 9 credits.
- ART 578. Seminar: Selected Topics in Art History 3 cr.  
Reading, research, and discussion of advanced problems. Prerequisite: graduate standing. May be repeated for a maximum of 9 credits.
- ART 579. Graduate Seminar: Art Theory, Criticism, Historiography 3 cr.  
Theories and methodologies in art history and art criticism. Prerequisite: graduate standing.
- ART 580. Printmaking Workshop 3-9 cr.  
Prerequisite: graduate standing. May be repeated for a maximum of 33 credits.
- ART 581. Printmaking, Professional study 1-3 cr.  
Professional development in the discipline of printmaking. May be repeated for a maximum of 6 credits.
- ART 585. Metals and Jewelry Design 3-9 cr.  
May be repeated up to 27 credits.
- ART 592. Visual Culture of the 1980s 3 cr.  
Focuses on major cultural trends and historical events in 1980s America. Offers analysis of art, films, and pop culture phenomena of the period. Fulfill all requirements of ART 392 plus graduate-level research. Prerequisite: either ART 297, ART 343, or consent of instructor.
- ART 593. History of Collage 3 cr.  
Examines theory and practice of collage, assembly, and montage in 2- and 3-dimensional, 20th century art. Emphasis on the art of the Schwitters, Picasso, Cornell, Hoch, Ernst, Ryan, Rauschenberg, and Schapiro. Fulfill all requirements of ART 393 plus graduate-level research. Prerequisite: either ART 297, ART 342, ART 343, or consent of instructor.
- ART 595. Problems in Studio 3-6 cr.  
Individualized study in specialized studio areas not covered by other advanced courses. Prerequisite: consent of instructor. May be repeated for a maximum of 9 credits.
- ART 596. Graduate Studio Seminar 3 cr.  
Explores issues in contemporary art making and their relationship to personal work. Presentation of research in oral, visual, and written form. Prerequisite: graduate standing. May be repeated for a maximum of 6 credits. Restricted to majors.
- ART 597. Readings in Art History 3 cr.  
In-depth study of historical writing about art. Prerequisite: graduate standing. May be repeated for a maximum of 9 credits.
- ART 598. Studio Thesis 1-88 cr.  
Special research in studio, leading to an exhibition and written thesis statement.
- ART 599. Art History Thesis 0-88 cr.  
Art history master's thesis research. Prerequisite: graduate standing. May be repeated for unlimited credit. Restricted to master's level art history students.

## ASTRONOMY

Department website: <http://astronomy.nmsu.edu/>  
(575) 646-5333  
[murphy@nmsu.edu](mailto:murphy@nmsu.edu)

*J. Murphy, department head, Ph.D. (Washington)-planetary atmospheres and exploration; K. S. Anderson, Ph.D. (Cal Tech)-extragalactic astronomy and peculiar galaxies; R. F. Beebe, Ph.D. (Indiana-Bloomington)-planetary astronomy and stellar spectra; N. Chanover, Ph.D. (New Mexico State)-planetary astronomy; C. Churchill, Ph.D. (California-Santa Cruz)-specialty galaxies and intergalactic medium; T. Harrison, Ph.D. (Minnesota)-cataclysmic variables and gamma-ray burst sources; J. Holtzman, Ph.D. (California-Santa Cruz)-stellar populations in*

*galaxies and theoretical cosmology, A. Klypin, Ph.D. (Moscow)-cosmology, B. J. McNamara, Ph.D. (California-Santa Cruz)-stellar photometry, star clusters, and gamma-ray astronomy, N. Vogt, Ph.D. (Cornell)-galaxy evolution, R. Waltherbos, Ph.D. (Leiden)-interstellar medium, star formation, and structure and evolution of galaxies, W. Webber, Ph.D. (Iowa)-high energy astrophysics*

The Department of Astronomy offers graduate work leading to the Doctor of Philosophy and Master of Science degrees. An undergraduate astronomy minor degree is offered as well. To be admitted as a regular student to the NMSU Graduate School as a major in astronomy, a student must present a suitable undergraduate background with emphasis (12-16 credits) on junior-senior level physics, and mathematics through differential equations. The prospective student is also required to take aptitude and physics (or approved specialized field) sections of the Graduate Record Examination.

Information on assistantships and fellowships in teaching and research can be obtained from the department.

Each entering graduate student will be assigned a committee that will guide the student in choice of courses, suggest training needed to remedy deficiencies (possibly to be taken without credit), and determine specific degree requirements in accord with the student's needs and objectives, and in agreement with departmental policies.

In addition to courses and research in astronomy (including 27 traditional course credit hours and 4 seminar-class credit hours), the Ph.D. student is required to take at least 6 credits of graduate-level coursework outside of the Department of Astronomy, beyond any deficiencies. These outside courses are most appropriately taken in the student's research focus area and are historically taken in the Physics, Electrical Engineering, Geology, and Mathematical Sciences departments. Each student must demonstrate no later than during the second year sufficient academic and research ability to qualify for continuation in doctoral studies.

It is possible, through arrangement with the Department of Physics, to obtain a Master of Science degree in physics during progress toward the Ph.D. in astronomy. See the "Department of Physics" section in this catalog for details of that program.

The M.S. degree in astronomy is closely connected with the astronomy Ph.D. program, and questions concerning requirements should be directed to the department.

Qualifying, Comprehensive and Final examinations are described elsewhere in this catalog. Questions concerning styles of the examinations should be directed to the department head.

The department operates three observatories. The first is the Apache Point 3.5-m telescope, which is run by the Astrophysical Research Consortium. The second is a 1-m telescope also at Apache Point, which is solely operated by NMSU and has a wide-field CCD-imaging system. The third observatory at Tortugas Mountain has a 24-inch telescope with a CCD imager for planetary research. The department is also a participant in the Sloan Digital Sky Survey project at Apache Point Observatory. The department is home to NASA's Planetary Data System's Planetary Atmosphere Node, at which solar system exploration data are archived.

## ASTRONOMY

- ASTR 461. Astronomy for Teachers 3 cr.  
Illustration and presentation of concepts of astronomy in different subject areas to broaden teacher preparation for science education in public schools.
- ASTR 500. Seminar 1 cr.  
Organized group study treating selected topics.
- ASTR 505. Astronomy and Astrophysics I (f) 3 cr.  
Application of physical principles to problems in modern astronomy. Emphasis will be on radiation mechanisms and radiation transfer in astronomical systems. Prerequisite: consent of instructor.
- ASTR 506. Astronomy and Astrophysics II (s) 3 cr.  
A sequel to ASTR 505 with emphasis on basic dynamics and (magneto) hydrodynamics. Prerequisite: consent of instructor.
- ASTR 508. Astronomy for Educators 3 cr.  
Assists K-12 teacher in developing pedagogy and content knowledge in the subject of astronomy. Addresses New Mexico benchmarks and standards.
- ASTR 515. Stellar Atmospheres 3 cr.  
Atmospheres of the sun and stars with emphasis on current theoretical models. Prerequisite: consent of instructor.
- ASTR 535. Observational Techniques I (f) 3 cr.  
Up-to-date introduction to modern observational astronomy in a two-

semester sequence. Topics include: introduction to computers, error analysis in data, the different types of optical telescopes, and optical and infrared photometry, image processing, and detectors.

- ASTR 536. Observational Techniques in Astronomy II (s) 3 cr.  
Sequel to ASTR 535. The second half of the course emphasizes observational techniques in spectroscopy, radio astronomy, and high energy astrophysics. Prerequisite: ASTR 535.
- ASTR 545. Stellar Spectroscopy 3 cr.  
Observational spectroscopy including instrumentation, observational techniques, classification, radial velocity methods, properties of stellar atmospheres, and interpretation of aggregate spectra such as galaxies and QSO's.
- ASTR 565. Stellar Interiors 3 cr.  
Internal constitutions of stars, computation of stellar models, and stellar evolution. Prerequisite: consent of instructor.
- ASTR 598. Special Research Programs 1-6 cr.  
Individual investigations, either analytical or experimental.
- ASTR 599. Master's Thesis 0-88 cr.  
Master's level research in astrophysics or observational astronomy.
- ASTR 600. Pre-dissertation Research 1-88 cr.  
Research.
- ASTR 605. Interstellar Medium 3 cr.  
Problems associated with gas and dust in the galaxy and with diffuse and planetary nebulae.
- ASTR 610. Radio Astronomy 3 cr.  
Techniques and observations stressing the operational approach to measurement and how the observations are intimately interwoven throughout modern astrophysics. Prerequisite: consent of instructor.
- ASTR 615. Galactic Structure 3 cr.  
The structure, composition and evolution of galaxies with special emphasis on our galaxy. Topics include solar motion, galactic kinematics, the structure of the disk and spheroid, star clusters, chemical evolution, and the classification of galaxies.
- ASTR 616. Galaxies 3 cr.  
Structure and evolution of galaxies; galaxy types, dark matter, x-ray gas in ellipticals, interacting and starburst galaxies, active galactic nuclei and quasars, and the physics of radio jets. Prerequisite: consent of instructor.
- ASTR 620. Planetary Science I 3 cr.  
Evaluation and analysis of observational data on solar system objects to determine their nature and physical conditions, with emphasis upon atmospheres (composition, structure, thermodynamics, evolution, etc.)
- ASTR 621. Planetary Science II 3 cr.  
The physical processes involved in planetary system formation are addressed. Specific foci include molecular cloud collapse, disk processes, and competing theories of planet formation within disks. Additional topics to be discussed may include: the solar wind, planetary magnetic fields, planetary ring processes, and mineralogy.
- ASTR 625. Cosmology 3 cr.  
Discussion of our current knowledge of the structure of the universe and current research methods. Topics include the distance scale, clustering of galaxies, large-scale structure, metrics, dark matter, and cosmological probes such as distant quasars, radio galaxies, and gravitational lenses. Prerequisite: consent of instructor.
- ASTR 675. Star Formation and Evolution 3 cr.  
The beginning and ending phases of stellar evolution. Topics include star formation and bipolar outflows, the basics of stellar interiors, evolution of close double stars, stellar mass loss, and the end phases of stellar evolution; planetary nebulae, neutron stars and black holes.
- ASTR 698. Special Topics. 1-9 cr.
- ASTR 700. Doctoral Dissertation 0-88 cr.  
Dissertation.

## BIOLOGY

Department website: <http://biology-web.nmsu.edu/>  
(575) 646-3611  
dahoward@nmsu.edu

*D. J. Howard, department head, Ph.D. (Yale)-evolution, P. C. Arrowood, Ph.D. (California-Davis)-ecology, C. D. Bailey, Ph.D. (Cornell)- plant systematics, M. H. Bernstein, Ph.D. (California-Los Angeles)-animal physiology, B. T. Bestelmeyer, Ph.D. (Colorado State University)- ecosystems, W. J. Boecklen, Ph.D. (Northern Arizona)-plant/insect and community ecology, J. L. Botsford, Ph.D. (Oregon*